

REMARKS

The Advisory Action of September 2, 2004 is acknowledged. In response, Applicants have attached the Request for Continued Examination (RCE) and request entry of the above Amendment.

CURRENT DISPOSITION OF THE CLAIMS

Per the Final Office Action mailed on May 10, 2004, Claims 1-4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of U.S. Patent 5,861,322 to Caillat in view of U.S. Patent Application Publication 2002/0109218 filed by Akram.

In making this rejection, the Examiner asserts:

At column 5, line 29 to column 6, line 43, Caillat discloses an electronic module, in particular a multichip module, comprising a multilayer wiring 104, 108, 112, 114, 118 having at least one IC component 130 applied on the component side thereof, said module being unilaterally covered on the component side with a case 134, and comprising a plurality of contact pads 138 on a bottom side of the module through for contacting and integration of the module to a next higher assembly group level, the bottom side of the multilayer wiring constituting directly, without additional wiring substrate, the bottom side of the module, the component side of the multilayer wiring adhering to the hermetic case with its portions that are free from components, the said hermetic case being formed by plastics overmolding, and in that the multilayer wiring has a height of less than approximately 100 µm, wherein the multilayer wiring is constituted by a sequence of structured metal planes which are electrically separated from each other by insulating layers 104, 114 and between which purposeful electric connections are established through vias, wherein solderable material 140 is applied to the contact pads on the bottom side of the multilayer wiring, electrically connected to the component side through vias, for establishing contact with the next higher assembly group level ("printed circuit board"), wherein the solderable material is applied in the form of solder balls.

The Examiner does state that "Caillat does not appear to explicitly teach a hermetic case." The Examiner further asserts, however, that:

Caillat discloses an underfill case 134, and at paragraph 0004, Akram discloses a hermetic "underfill" case. Moreover, it would have been obvious to use the hermetic underfill case of Akram as the underfill case of Caillat because, as taught by Akram, it would provide environmental protection and enhance the attachment of the component to the wiring.

Therefore, the Examiner believes:

it would have been obvious to substitute or combine the underfill case of Akram for or with the underfill case of Caillat because it would provide an underfill case, and use/substitution of a known element based on its suitability for its intended use has been held to be *prima facie* obvious. Also, it would have been obvious to substitute the underfill case of Akram for the underfill case of Caillat because it would provide an underfill case when the use of the underfill case of Caillat becomes infeasible, e.g., when the underfill case of Caillat is cost ineffective or when it is unavailable due to a supply disruption.

The Applicants respectfully disagree with this characterization.

The Teachings of Caillat

Caillat teaches rigidly connecting chip 130 to the interconnection substrate 101 by way of an underfill encapsulate (column 6, lines 19-21, Fig. 10). Caillat gives no indication of any other purpose for including underfill 134. Moreover, Caillat discloses a separate cover 136 that functions to protect both chip 130 and underfill 134. See Caillat, Column 6, Lines 19-21; Figs. 9-11.

The Teachings of Akram

Akram does not teach a hermetic "underfill" case as asserted by the Examiner. Rather, Akram teaches using underfill materials in the same manner as taught by Caillat. In Akram, paragraph 4 explains: "[G]lop top *and* underfill materials are often used to hermetically seal the flip chips on the substrate." See Akram, ¶ [0004] (emphasis added). Akram continues, "[A]n underfill encapsulate is generally disposed between the semiconductor chip and the printed circuit board or substrate for environmental protection and to enhance the attachment of the semiconductor die to the substrate." *Id.* The remainder of the fourth paragraph of Akram explains that in some applications, the back surface of the semiconductor chip is not protected because underfill material alone is used in the semiconductor assembly.

In paragraph 5, Akram further explains, "[S]ince the underfill encapsulate alone does not protect the back of the dice, an additional protection step of providing a glob top is typically used." See Akram, ¶ [0005]. This is shown in Fig. 1, which depicts underfill 114 only being located below chip 104 with the underfill 114 merely serving to reinforce the electrical connections 108 connecting the chip 104 to the substrate 106. This configuration would leave chip 104 exposed to air, if not for the addition of encapsulate

102. It is the flow of the encapsulate 102 around the chip 104 and over the underfill 104 that hermetically seals the multilayer wiring including the chip.

As explained in Akram, the glob top 102 and the underfill 104 consist of different materials, even though both may be made of epoxy or silicone polymers. Specifically, Akram teaches that "the addition of glob materials can induce detrimental stresses that can cause catastrophic failures. The stresses occur when the glob top is cured and has different mechanical characteristics such as an expansion coefficient compared to the underfill material." See Akram, ¶ [0005]. Accordingly, it is incorrect to characterize Akram as teaching using an underfill material as a hermetical seal when Akram clearly teaches that the combination of the underfill material *and* the glob top form a hermetic seal.

The Present Invention

The present invention comprises an electronic module with multilayer wiring, including at least one IC component, applied on the component side of the module. The module is unilaterally covered on the component side with a hermetic case. The hermetic case is formed via plastic overmolding.

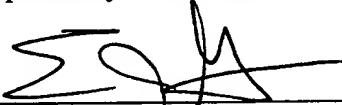
With this amendment, Applicants have clarified the hermetic case formed by the plastic overmolding comprises a single material. This amendment further distinguishes claim 1 from the teaching of Akram relating to the hermetic case. As explained above, Akram teaches utilizing glob top *and* underfill materials to hermetically seal the chips on a substrate. Thus, Akram requires two different materials in hermetically sealing the chip. Claim 1, conversely, limits the plastic overmolding to a single material. Thus, Akram does not teach this claim limitation.

The Examiner concedes that Caillat does not teach a hermetic case. Accordingly, Applicants assert that claim 1 must be allowable over the combination of Caillat and Akram, since both Caillat and Akram fail to teach a plastic overmolding comprising a single material that functions as a hermetic case. Moreover, as all remaining pending claims ultimately depend from claim 1, Applicants assert that all claims are in condition for allowance.

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With the above Amendment and Remarks of record, Applicants consider all pending claims 1-4 to be in condition for allowance and respectfully request such from the Examiner. Applicants believe the appropriate fee for this RCE are enclosed; however should an additional extension fee be required, please consider this a request for such and charge Baker & Daniels Deposit Account No. 02-0387 (75327.63) or credit any overpayment thereto. However, please do not include the payment of issue fees.

Respectfully submitted,

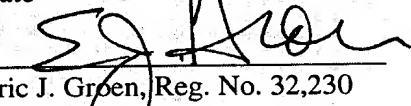

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